

Final Progress Report—NAG 5-4825
HRI Observations of Balmer Dominated Filaments in
the SNR RCW86
PI: Knox S. Long, STScI
September 27, 1999

Brief Description of the Project

The objective of this project was to use the ROSAT HRI to study the recently discovered optical Balmer-dominated filaments in the young SNR RCW86. The observations provide complete high-resolution X-ray coverage of the shell of the SNR. These X-ray observations are combined with new optical observations (both imaging and spectroscopic), and new high resolution radio observations to provide a better overall understanding of the state of the remnant (Sedov or reverse shock), its history (as the possible SNR of SN 185 AD), and the physics of non-radiative shocks.

Progress to date

The ROSAT HRI observations have been received and combined with the two older HRI pointings from AO5 to make a complete high-resolution X-ray mosaic of RCW 86. Comparison with our deep optical image shows excellent correlation between optical and X-ray filaments. We presented a preliminary analysis of the optical images combined with ROSAT PSPC and HRI data at the January 1998 AAS meeting (1997, BAAS, 191, 4001) - see abstract below.

We have also obtained most of the new supporting radio and optical data. Through collaboration with a group led by John Dickel, we have obtained a high-resolution radio mosaic of RCW 86, which will allow us to perform a detailed X-ray/radio comparison on a filament by filament basis. Preliminary comparisons show that there is little spatial correlation between the radio and X-ray filaments. This result in the radio is contrary to what we find in the optical. Detailed analysis, led by Dickel, is now underway.

At optical wavelengths, we have undertaken an extensive spectroscopic study of the filaments to determine the physical conditions at the shock itself. These observations consist of moderate resolution spectroscopy, covering

from $H\alpha$ to $H\beta$ to measure the widths of the broad-component of these emission lines, and high resolution Echelle observations to measure the widths of the narrow component of the emission from these non-radiative shocks. The broad component widths can provide information about the shock velocities and geometries, while the narrow component width provides information on the presence of shock pre-cursors.

Our optical spectroscopy was delayed for a year by bad weather, but during June 1999 we obtained a reasonably good set of spectroscopic data all along the remnant's periphery. These data are being reduced by a graduate student (Parviz Ghavamian, Rice University) who plans to model the shock front based primarily on the optical data. His modeling will be combined with the spatial and spectral information in the X-ray (from both our HRI and PSPC data sets) to better understand the physical conditions both in front of and behind

In summary, we have made progress analyzing the X-ray data we have in hand, we have presented the results in preliminary form, and we are working on combining the optical, radio, and X-ray datasets to develop a detailed understanding of the SNR RCW 86 and the mixture of radiative and non-radiative shocks which define its shell.

Publications

- 1997 BAAS, 191, 4001

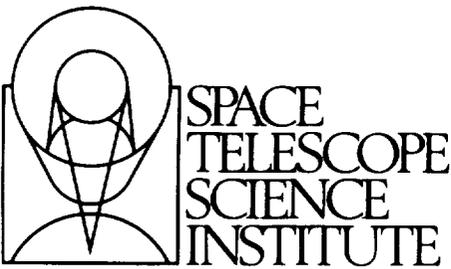
A Detailed Optical/X-ray Comparison of SNR RCW 86

R. C. Smith (Univ. of Michigan/CTIO), K. S. Long (STScI)

We present a detailed optical/X-ray comparison of the filaments of the Galactic SNR RCW 86 (also known as G 315.2-2.3 or MSH 14-63). The optical data consist of deep $H\alpha$ and [S II] emission line images taken with the UM/CTIO Curtis Schmidt telescope, and the X-ray dataset is composed of deep ROSAT PSPC and HRI images of the remnant.

Our preliminary analysis of the HRI dataset (using only the two pointings available out of the four scheduled) shows no significant offset between the X-ray emission in the high-resolution HRI images and the sharp Balmer-dominated filaments. The Balmer-dominated filaments do however bound the X-ray filaments along all the sampled regions. The PSPC data show significant spectral variation around the remnant, which we interpret as tem-

perature variations. We present an approximate temperature map based on the ratio of Snowden bands (6+7 over 3+4), and discuss the possible sources of the observed variations. This work was supported in part by NASA grant NAG5-4825 and the Dean B. McLaughlin Fellowship.



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October 7, 1999

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Goddard Space Flight Center
Greenbelt, MD. 20771

Reference: NAG5-4825
STScI WBS# J0552
PI: Dr. Knox Long
Final Report

Dear Mr. Poston,

I am pleased to enclose a copy of the Final Technical Report, the Final Property Report for the above referenced grant entitled, "*HST Observations of Balmer Dominated Filaments in the SNR RCW86*" under the direction of Dr. Knox Long.

Should you have questions or require additional information, please contact me at 410.338.4364 or larisad@stsci.edu.

Sincerely,

A handwritten signature in cursive script that reads "Larisa Dolhancryk".

Larisa Dolhancryk
Sponsored Programs Administrator I

Enclosure

cc: ONR, Closeout Team
CASI, Acquisitions Rept. ✓